DEC 0 3 1985

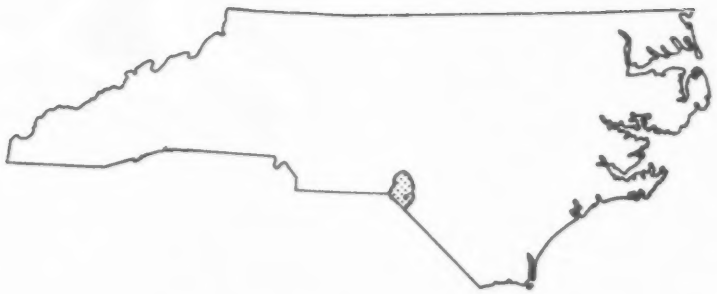
FEM 1.2:370222
16
COMPLETED

FLOOD INSURANCE STUDY

ORIGINAL

CITY OF LAURINBURG, NORTH CAROLINA

SCOTLAND COUNTY



JANUARY 3, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 370222

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgements	1
1.3	Coordination	2
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	2
2.4	Flood Protection Measures	2
3.0	ENGINEERING METHODS	4
3.1	Hydrologic Analyses	4
3.2	Hydraulic Analyses	5
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	5
4.1	Flood Boundaries	5
4.2	Floodways	6
5.0	INSURANCE APPLICATION	6
5.1	Reach Determinations	6
5.2	Flood Hazard Factors	6
5.3	Flood Insurance Zones	7
5.4	Flood Insurance Rate Map Description	7

BEST COPY AVAILABLE

TABLE OF CONTENTS (Continued)

		Page
6.0	OTHER STUDIES	7
7.0	LOCATION OF DATA	9
8.0	REFERENCES AND BIBLIOGRAPHY	9

FIGURES

Figure 1 - Vicinity Map 3

TABLES

Table 1 - Summary of Discharges 4

Table 2 - Flood Insurance Zone Data 8

EXHIBITS

Flood Profiles

Leith Creek Panel 01P

Flood Insurance Rate Map Index
Flood Insurance Rate Map

BEST COPY AVAILABLE

FLOOD INSURANCE STUDY

CITY OF LAURINBURG,
SCOTLAND COUNTY,
NORTH CAROLINA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Laurinburg, Scotland County, North Carolina, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared originally for purposes other than the National Flood Insurance Program. The data were identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. The Federal Emergency Management Agency (FEMA) performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the National Flood Insurance Program. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, Federal Emergency Management Agency, Atlanta, Georgia for consideration for revision of this study.

1.2 Authority and Acknowledgements

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were obtained from a U.S. Army Corps of Engineers (COE) study entitled, "Detailed Project Report, Leith Creek, Scotland County, North Carolina" (Reference 1).

BEST COPY AVAILABLE

1.3 Coordination

On February 27, 1985, the results of this study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Laurinburg, Scotland County, North Carolina. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data. Leith Creek was studied in detail within the corporate limits.

Approximate methods of analysis were used to study all remaining areas having a potential flood hazard that did not have available detailed scientific or technical data.

2.2 Community Description

The City of Laurinburg is located in southeastern Scotland County in southern North Carolina. Approximately 43 miles southwest of Fayetteville and 96 miles southeast of Charlotte, Laurinburg is bordered on the southeast by the City of East Laurinburg and on all other sides by unincorporated areas of Scotland County. According to the 1980 census, the City of Laurinburg had a population of 11,480, a 30-percent increase over the 1970 population of 8,859 (Reference 2).

The climate in southern North Carolina is typical of the warm temperature zone with an average annual temperature of 62 degrees Fahrenheit (F.). Temperatures range from 44 degrees F. in winter to 79 degrees F. in summer. The normal annual rainfall is 46 inches (Reference 1).

Leith Creek, which flows southerly through Laurinburg, has a drainage area of 13.26 square miles at its confluence with Little Creek.

Both agricultural and urban development exist within the flood plain. Agricultural development, composed of about two-thirds of the total, consists of cropland and forest. The remainder is urban, comprised of residential and small business.

2.3 Principal Flood Problems

No information is available regarding flooding problems in the City of Laurinburg.

2.4 Flood Protection Measures

The Leith Creek channel has been improved, and the flood plain has been designated as a recreational area. Structural and nonstructural improvements were made.

BEST COPY AVAILABLE

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LAURINBURG, NC

(SCOTLAND CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

BEST COPY AVAILABLE

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

For Leith Creek at Laurinburg, discharge values were developed by the COE using a statistical analysis of occurring floods for both existing conditions at the time the detailed project report was written and for the improvements that are now in effect (Reference 1).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LEITH CREEK					
at U.S. Routes 15 and 401	7.93	690	1,260	1,380	2,550
at Laurinburg and Southern Railway	12.19	950	1,640	1,920	3,600

BEST COPY AVAILABLE

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the stream and flood plain areas. Channel values for Leith Creek ranged from 0.06 to 0.10 and from 0.06 to 0.16 for the overbank areas (Reference 1).

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 3). This computer model was calibrated using historic floodwater profiles. Starting water-surface elevations were computed by the slope-area method.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 4).

Flood plain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zone A and numbered A zones) and the 500-year flood plain boundary corresponds to the boundary of areas of

BEST COPY AVAILABLE

moderate flood hazards (Zone B). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. No floodway was computed for Leith Creek.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Laurinburg.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the weighted average difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the riverine flooding sources of the City of Laurinburg are shown on the Flood Profiles and summarized in Table 2, Flood Insurance Zone Data.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a riverine reach is the weighted average difference between the 10- and 100-year flood water-surface elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code. For example, if the difference between elevations is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference is greater than 10.0 feet, it is rounded to the nearest whole foot.

BEST COPY AVAILABLE

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zones A5 and A9:	Special Flood Hazard Areas inundated by the 100-year flood, with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- and 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and, areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 2, Flood Insurance Zone Data.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Laurinburg is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines for riverine flooding sources show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the City of Laurinburg (Reference 5).

BEST COPY AVAILABLE

BEST COPY AVAILABLE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
LEITH CREEK							
REACH 1	0001	−2.5	−0.3	1.5	025	A5	VARIES – SEE MAP
REACH 2	0001	−4.5	−1.0	1.5	045	A9	VARIES – SEE MAP
REACH 3	0001	−2.5	−0.8	3.5	025	A5	VARIES – SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LAURINBURG, NC
(SCOTLAND CO.)

FLOOD INSURANCE ZONE DATA

8

LEITH CREEK

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 1371 Peachtree Street, NE., Suite 736, Atlanta, Georgia 30309.

8.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Army Corps of Engineers, Detailed Project Report, Leith Creek, Scotland County, North Carolina, January 1977.

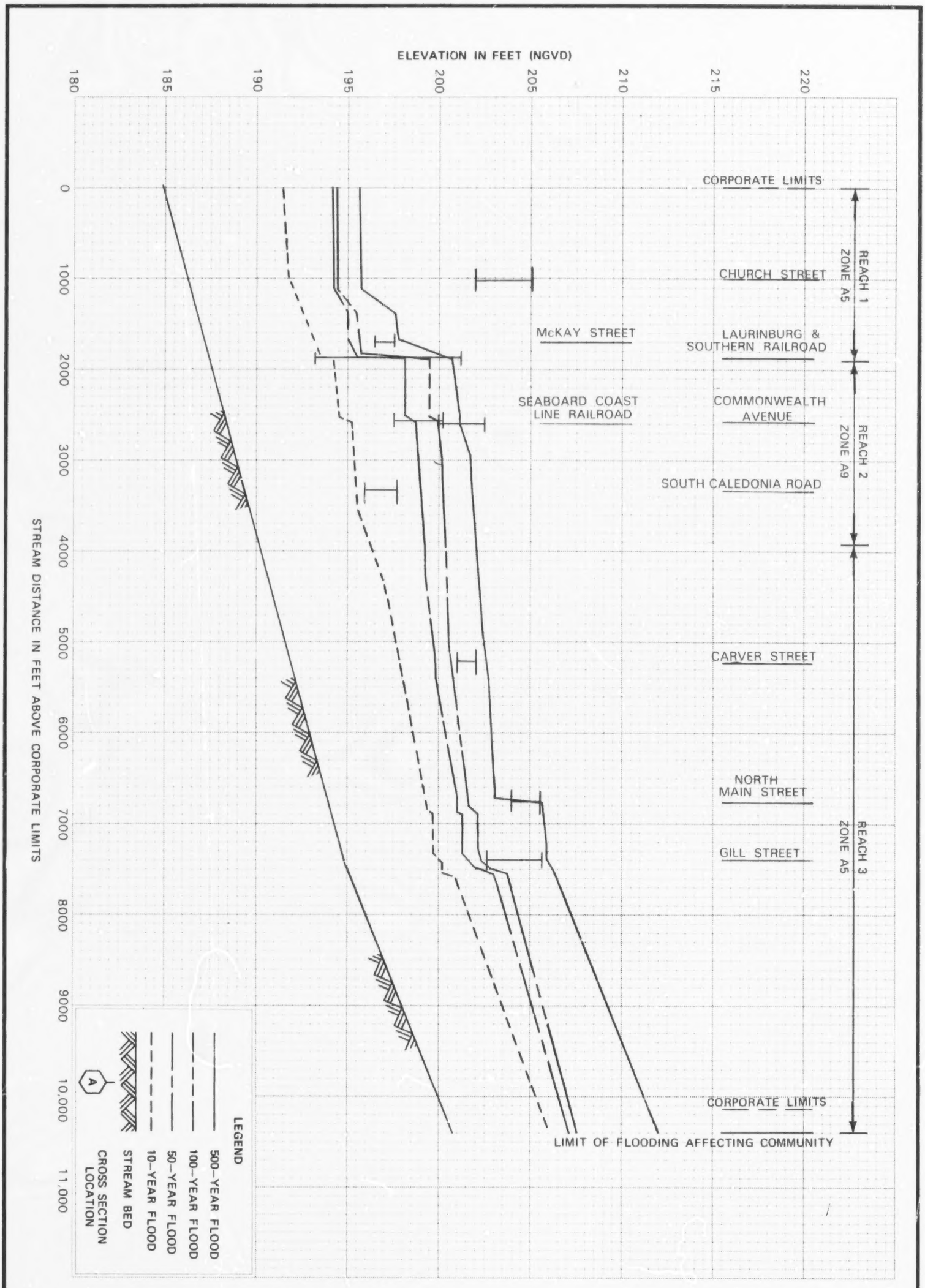
2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, North Carolina, Washington, D.C., February 1982.

3. U.S. Army Corps of Engineers, Hydraulic Engineering Center, HEC-2 Step-Backwater Model, Davis, California, December 1968 with updates.

4. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 feet: Laurinburg, North Carolina, 1957.

5. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Laurinburg, North Carolina, August 1976.

BEST COPY AVAILABLE



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF LAURINBURG, NC** (SCOTLAND CO.)	**FLOOD PROFILES** **LEITH CREEK**

BEST COPY AVAILABLE